MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

EME2036 – MANUFACTURING AND OPERATIONS MANAGEMENT

(ME/RE)

6 OCTOBER 2015
9.00 - 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 7 pages including cover page with 5 Questions.
2. Attempt **ALL** questions.
3. Please write all your answers in the answer booklet provided. Show all relevant steps to obtain maximum marks.
4. You may use the appendices in page 7 whenever necessary.

Question 1

(a) Shirley Hopkins is developing a program in leadership training for middle-level managers. Shirley has listed a number of activities that must be completed before a training program of this nature could be conducted. The activities, immediate predecessors, and times appear in the **Table Q1(a).**

Table Q1(a)

Activity	Activity Time (weeks)	Immediate Predecessors
A	5	-
B	4	-
C	2	A
D	5	B
E	3	B
F	4	C, D
G	7	E
H	2	F, G

i. Develop an AON network for this problem. **[8 marks]**

ii. What is the critical path and total project completion time? **[1.5 marks]**

iii. what is the slack time for activities C, D and F. **[1.5 marks]**

(b) Auto pistons at Yongpin Zhou's plant in Shanghai are produced in a forging process, and the diameter is a critical factor that must be controlled. From sample size of 10 pistons produced each day, the mean and range of this diameter have been as shown in **Table Q1 (b).**

Table Q1 (b)

Day	Mean (mm)	Range (mm)
1	156.9	4.2
2	153.9	4.6
3	153.8	4.1
4	155.5	5.0
5	156.3	4.5

i. Calculate the process average and range. **[2 marks]**

ii. Calculate the upper and lower limits for R-chart and $\bar{X}$-bar chart. **[5 marks]**

iii. Determine if the process is in statistical control (Explain your reason). **[2 marks]**

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Question 2

(a) A television manufacturer would like to reduce its inventory. To this end, you are asked by the operations manager to assess its inventory level. You have the following information on average inventories from last year's financial statement:
Raw materials: $1,500,000
Work-in-process: $1,200,000
Finished goods: $800,000
In addition, the cost of goods sold last year (50 weeks) was $20 million.

i. Calculate its total inventory (measured as weeks of supply). **[6 marks]**

ii. Find its inventory turnover. **[2 marks]**

(b) The partially completed inventory record for the tabletop subassembly in **Table Q2(b)** shows gross requirements, scheduled receipts, lead time, and current on-hand inventory. (lead time=2 weeks)

i. Complete the table for an FOQ of 120 units. **[6 marks]**

ii. Complete the table by using the L4L lot-sizing rule. **[6 marks]**

Table Q2(b)

Lead time: 2 weeks	week							
	1	2	3	4	5	6	7	8
Gross requirement	90		80		80		40	110
Scheduled receipt	130							
Project on-hand inventory *30*								
Planned receipt								
Planned order release								

Continued .....

Question 3

(a) Wood County Hospital consumes 1,000 boxes of bandages per week. The price of bandages is $35 per box, and the hospital operates 52 weeks per year. The cost of processing an order is $15, and the cost of holding one box for a year is 15 percent of the value of the material.

i. Determine the annual ordering, holding, and total inventory cost if the hospital order bandages in lot sizes of 900 boxes. **[5 marks]**

ii. Calculate the optimal order quantity and the optimal number of orders per year by using the EOQ method. **[3 marks]**

iii. What extra cost could be saved if the hospital use the EOQ method? **[2 marks]**

(b) The Winston company has determined the "demand points" and their relative locations as shown in **Table Q3(b).**

Table Q3(b)

Demand Points	*X* Coordinate	*Y* Coordinate	Load (tons)
A	10	11	150
B	21	18	150
C	15	12	200
D	21	15	250

i. If a company desires to locate a manufacturing facility at the center of gravity, what would be the *x* and *y* coordinates of the facility? **[5 marks]**

ii. Calculate the resulting load-distance score for this location by using rectilinear distance. **[5 marks]**

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Question 4

Karl's Copiers sells and repairs photocopy machines. The manager needs weekly forecasts of service calls so that he can schedule service personnel. The weekly demand of service calls are listed in **Table Q4**.

Table Q4

Week	Actual service calls
1	24
2	32
3	36
4	23
5	25

(a) Use the exponential smoothing method to forecast the number of calls for week 2 to 6. The manager uses exponential smoothing with $\alpha = 0.20$. The initial forecast for first week is 25 calls. **[5 marks]**

(b) By suing the number of calls forecasted in part (a), calculate the absolute percentage error of weeks 1 to 5 and the MAD and MAPE of forecast error as of the end of week 5. **[12 marks]**

(c) Forecast the number of calls from week 4 to 6 by using simple moving average method with n=3. **[3 marks]**

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Question 5

(a) The delivery wagon that a seller of sandwich had used for the last three decades was beyond repair, so he decided to open a stand at a busy intersection in downtown. Customers arrive at the rate of 8 per hour and it takes 5 minutes on average to receive their orders.

i. Determine the average waiting time in line. **[3 marks]**

ii. Find the average number of customers in line. **[2 marks]**

iii. What is the likelihood that the line is longer than three people? **[5 marks]**

(b) Currently a company that designs web sites has five customers in its backlog. The day when the order arrived, processing time, and promised due dates are given in the **Table Q5(b)**. The customers are listed in the order of when they arrived.

Table Q5(b)

Job	Process Time (days)	Due Time (days)	Days Since Arrival
A	2	7	12
B	8	16	9
C	4	4	8
D	10	17	5
E	5	15	3
F	12	18	2

i. Develop a schedule by using the earliest due date (EDD) rule. **[6 marks]**

ii. Find the average flow time. **[2 marks]**

iii. Calculate the average days past due. **[2 marks]**

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APPENDICES

List of Equations:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad \sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

$UCL_R = D_4\bar{R}$ and $LCL_R = D_3\bar{R}$

$UCL_{\bar{X}} = \bar{\bar{X}} + A_2\bar{R}$ and $UCL_{\bar{X}} = \bar{\bar{X}} - A_2\bar{R}$

$$C = \frac{Q}{2}(H) + \frac{D}{Q}(S) \qquad EOQ = \sqrt{\frac{2DS}{H}} \qquad TBO_{EOQ} = \frac{EOQ}{D}\ (12\ months/year)$$

$$x^* = \frac{\sum_i l_i x_i}{\sum_i l_i} \text{ and } y^* = \frac{\sum_i l_i y_i}{\sum_i l_i} \qquad d_i = |x_i - x^*| + |y_i - y^*| \qquad ld = \sum_i l_i d_i$$

$$F_{t+1} = \alpha D_t + (1-\alpha) F_t \qquad MAD = \frac{\Sigma|E_t|}{n} \qquad MAPE = \frac{(\Sigma\frac{|E_t|}{D_t})(100)}{n}$$

$$\rho = \lambda/\mu \qquad P_n = (1-\rho)\rho^n \qquad L = \lambda/(\mu-\lambda)$$

$$Lq = \rho L \qquad W = 1/(\mu-\lambda) \qquad W_q = \rho W$$

List of Tables:

Table 1: Factors for calculating three-sigma limits

Size of Sample (n)	Factor for UCL and LCL for $\bar{x}$-Chart (A_2)	Factor for LCL for R-Chart (D_3)	Factor for UCL for R-Chart (D_4)
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

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